Peer Community In Archaeology

Online presentation of the digital reconstruction process of a megalithic tomb : “3Duewelsteene”

Sophie C. Schmidt *and* ***James Allison*** *based on peer reviews by* ***Scott Ure***, ***Ronald Visser*** *and* ***Robert Bischoff***

Tharandt, Louise (2024) 3Duewelsteene - A website for the 3D visualization of the megalithic passage grave Düwelsteene near Heiden in Westphalia, Germany. Zenodo, ver. 4, peer-reviewed and recommended by Peer Community in Archaeology.
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“3Duewelsteene - A website for the 3D visualization of the megalithic passage grave Düwelsteene near Heiden in Westphalia, Germany” (Tharandt 2024) presents several 3-dimensional models of the Düwelsteene monument, along with contextual information about the grave and the process of creating the models. The website (https://3duewelsteene.github.io/) includes English and German versions, making it accessible to a wide audience. The website itself serves as the primary means of presenting the data, rather than as a supplement to a written text. This is an innovative and engaging way to present the research to a wider public.

Düwelsteene (“Devil’s Stones”) is a megalithic passage grave from the Funnel Beaker culture, dating to approximately 3300 BC. to 2600 BC. that was excavated in 1932. The website displays three separate 3-dimensional models. They ares shown in the 3D viewer software 3DHOP, which enables viewers to interact with the models in several ways, Annotations on the models display further information.

The first model was created by image-based modeling and shows the monument as it appears today.

A second model uses historical photographs and excavation data to reconstruct the grave as it appeared prior to the 1932 archaeological excavation. Restoration work following the excavation relocated many of the stones. Pre-1932 photographs collected from residents of the nearby town of Heiden were then used to create a model showing what the tomb looked like before the restoration work. It is commendable that a “certainty view” of the model shows the certainty with which the stones can be put at the reconstructed place. Gaps in the 3D models of stones that were caused by overlap with other stones have been filled with a rough mesh and marked as such, thereby differentiating between known and unknown parts of the stones.

The third model is the most imaginative and most interesting. As it shows as the grave as it might have appeared in approximately 3000 B.C., many aspects of this model are necessarily somewhat speculative. There is no direct evidence for exact size and shape of the capstones, the height of the mound, and other details. But enough is known about other similar constructions to allow these details to be inferred with some confidence. Again, care was taken to enable viewers to distinguish between the stones that are still in existence and those that were reconstructed.

A video on the home page of the website adds a nice touch. It starts with the model of the Düwelsteene as it currently appears then shows, in reverse order, the changes to the grave, ending with the inferred original state.

The 3D reconstructions are convincing and the methods well described. This project follows an open science approach and the FAIR principles, which is commendable and cutting edge in the field of Digital Archaeology. The preprint of the website hosted on zenodo includes all the photos, text, html files, and nine individual 3D model (.ply) files that are combined in the reconstructions exhibited on the website. A "readme.md" file includes details about building the models using CloudCompare and Blender, and modifications to the 3D viewer software (3DHOP) to get the website to improve the display of the reconstructions. We have to note that the link between the reconstructed models and the html page does not work when the files are downloaded from zenodo and opened offline. The html pages open in the browser, and the individual ply files work fine, but the 3D models do not display on the browser page when the html files are opened offline. The online version of the website is working perfectly.

The 3Düwelsteene website combines the presentation of archaeological domain knowledge to a lay audience as well as in-depths information on the reconstruction process to make it an interesting contribution for researchers. By providing data and code for the website it also models an Open Science approach, which enables other researchers to re-use these materials. We congratulate the author on a successful reconstruction of the megalithic tomb, an admirable presentation of the archaeological work and the thoughtful outreach to a broad audience.

Bibliography

Tharandt, L., 3Duewelsteene - A website for the 3D visualization of the megalithic passage grave Düwelsteene near Heiden in Westphalia, Germany, https://3duewelsteene.github.io/, Zenodo, 7948379, ver. 4 peer-reviewed and recommended by Peer Community in Archaeology. https://doi.org/10.5281/zenodo.7948379

Reviews

Evaluation round #2

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Version of the preprint: 2

Authors' reply, 01 January 2024

While I hope that I have fixed most problems, I am not sure why the models didn't load. I have checked the website and everything now loads for me. But I did notice that the models won't show, when I open each html document, after downloading the GitHub zip. Did that work for the first version?

Thank you so much for the feedback!

Decision by Sophie C. Schmidt and James Allison, posted 14 November 2023, validated 15 November 2023

Only one small correction needed for recommendation

The very positive reviews of the website speak of a great contribution to the communication of archaeological review to a wider public and an innovative way to present a master thesis project. This second version of the pre-print has been improved regarding most of the topics mentioned by the reviews of the first round. Thank you!

The reviewers suggest some further changes to the website. The most important thing is that the 3D models apparently don't load properly. The recommenders ran into the same problem as the reviewer. That problem obviously needs to be fixed before we can recommend the contribution. We agree that the other suggested changes (see esp. review by Scott Ure) would improve the visitor experience, but we do not think they are necessary for accepting the website as a valuable contribution to the CAA proceedings. Should it be possible, we would welcome a link to the MA thesis as suggested by Ronald Visser, but again, for a recommendation only the technical problem regarding the 3D models needs to be fixed.

Reviewed by Ronald Visser, 20 October 2023

This is the second review of an improved website. I will therefore only address the issues and improvements. I am repeating the positive things of the first review.

The Github-repository under review shows an interesting way of sharing both archaeological information and 3D-models, using existing technologies (3DHop, Java-script, CSS, etc). The approach is clear and straightforward and is a low-cost approach. In addition, it follows the ideals of open science and FAIR-principles. I think that this is all commendable, since it makes archaeological information and archaeological reconstructions available for a wide public.

The context of the website, a Master-thesis is mentioned, and it would be helpfull to add a link to the document, or the document itself. As stated in the previous review, the intended audience is not made explicit, but it might appeal to a broad audience. I would really suggest that you would add this to the "About" section or the Readme.md.

It is commendable that the website is available in both English and German, since it enables a wider public to access the information. Since the Düwelsteenen are found close to the Dutch border, a Dutch version, might be a future addition to pursue. The English has been improved strongly in the version. Thank you!

The technologies behind the website are all open (except GoogleMaps) and fairly common in the archaeological community. In that sense the website builds further on what other archaeologists have done, and the use of relative standard technologies also improves the long lived availability of the 3D-models, information and website itself. However, I am not a specialist in building websites, so maybe a specialist in that field might think differently.

I really liked reading the Readme.md, since it explained several of the technological choices made to solve certain issues. I am looking forward to read a scientific paper that would explain various things on the website/Github-repository, and including the (scientific) backgrounds. In addition, to adhere better to the FAIR-principles a more complete metadata document would also improve the data set itself.

I have really enjoyed going through the website both in English and German. I think that this is a really nice contribution, although the scientific background should really be explained in a paper or with a link to the thesis behind the website. All in all it is a valuable contribution to archaeology and public outreach!

Reviewed by Scott Ure, 16 October 2023

3Düwelsteene: The 3D Reconstructions of the Megalithic Grave "Devil Stones" near Heiden, Westphalia

Revision Round #2

The primary focus for this website is to share a digital reconstruction, history, location, and legends/tales for the Düwelsteene megalithic tomb. The website offers a user-friendly, open science approach for users to interact with the data and information related to this site. It will appeal to those living in the region, as well as to researchers studying megalithic tombs more broadly. The intended audience appears to be a mix between the public and professionals, but I do not find that this detracts from the overall message. Both user groups can find varying depths of information based on their interest level.

The author's revisions from round 1 address most of the suggestions provided by the reviewers, but a few issues remain that should be resolved. The overall goal for this website is reflected in the title, but unlike a traditional paper, there is little introduction to the website on the main "index.html" page. The video helps offer some context, and the statement at the bottom of the page provides some additional information, but a brief explanation stating the purpose for the website needs to be right at the top with the title. Perhaps moving the "Reconstructions" section at the bottom of the page to the top will help provide that foundation for the rest of the website. You might also consider adding the "Context" information in the ReadMe file here as well.

This may be personal preference, but a logical path through the website is not clear to me and may cause confusion for other users. I recognize that a website can be a non-linear way of accessing data, but it also leaves me bouncing around from section to section. Perhaps I am too used to reading papers that give a more linear order to the content, and maybe this is one of the challenges with using a website. Is there a better way to organize the information that leads the reader from the beginning of the story to the end? Could the website start the reader with a brief introduction to the project and then lead them through the early history and excavations and end with your reconstructions? The menu button would still allow people to move to other sections if they chose, but there would still be a basic organization to the information. Again, perhaps moving the "About" box at the bottom to the top of the "Index.html" would be a starting point.

On the "about_en.html" page, the first thing I noticed was the amazing sequence of images at the top. I would recommend adding a caption to these images to explain what the user is seeing. I really enjoy the "History of the excavation" and "Tales" sections here. I think both audiences will appreciate them, and I would add more content here in future editions, if it is available. These sections add a rich, human element to your research. I would recommend formatting your image captions in a way that makes them stand out from the main text. You could use a smaller font size or italics to make this differentiation and improve readability. I would recommend doing the same for the sources, or you could add a line between the sources and the main text. I am curious about publishing location and access information for the site. I assume the site is open to visitors and is monitored? Do you need permission to share the location? I am not familiar enough with the local laws and regulations, but it might be something to consider if you have not already.

The "methods_en.html" page adds essential, valuable information that was missing in the first version. This webpage really strengthens your overall product by explaining how you collected and processed the data. Although SFM is fairly well known now, explaining your methods adds that all-important replicability necessary for any scientific endeavor. I also appreciated the addition of the comparative tombs used to facilitate and justify your reconstruction of Düwelsteene.

On the "3D_Today-en.html" I first noticed that the 3D reconstruction did not work on the version I was using. I can see the grid and controls, but I did not see a model that I could navigate. I would also move the "Reconstructions" section to the top of the webpage so that users can more easily navigate between the different time periods. Alternatively, you could add tabs for each section at the top to make it easier to navigate. I also noticed that some of the images are highly detailed but small and hard to see. Perhaps you could open a full-sized version if clicked on by a user?

Final thoughts: the new additions to this version add important background information and methods that

strengthen the website considerably. These additions help justify the interpretations, but especially the 3000 BC version. The 3D models are well made and add valuable visual representations that provide a dimension not possible in paper formats. I would recommend reviewing the overall organization and flow to the website (see notes above), check the functionality of the main 3D model reconstruction, and find a native English speaker to review the grammar and structure, as noted in the previous reviews. The changes are minor but necessary. You should, however, be proud of producing a high-quality English version that only needs a little tweaking. Gut gemacht!

Reviewed by Robert Bischoff, 18 October 2023

This is the second review of the submission titled "3Duewelsteene - A website for the 3D visualization of the megalithic passage grave Düwelsteene near Heiden in Westphalia, Germany. This review confirms that the suggested revisions were made. This website will be an excellent resource for anyone interested in the Düwelsteene megalithic tomb or in megalithic tombs in general. It is also an excellent example of scientific reconstructions of archaeological structures and their public presentation.

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.5281/zenodo.7948380
Version of the preprint: 1

Authors' reply, 17 September 2023

Thank you for the helpful and encouraging reviews. I have edited and included all suggestions of the reviewers. I have also added a new webpage to the website containing more information on the methods and workflow used to capture the digitised megalithic tomb (Image-based Modeling) as well as how the reconstruction of the Düwelsteene 3000 B.C. was built.

While some of the text has been revised and checked for grammar and spelling, I have not managed to get a native speaker to go over the english website in time. I hope I can update the website with a better english version in the coming month.

Decision by Sophie C. Schmidt and James Allison, posted 18 July 2023, validated 19 July 2023

Positive reviews for the Düwelsteene website with some recommendations to improve

The website on the Düwelsteene has been positively commented upon by all three reviewers. All agree that it is a very suitable way to present the research to a wider public and that the reconstructions were very well developed. It has been commended to follow an open science approach and the FAIR principles, though the metadata could be imroved upon.

There is some concern regarding the depth of information presented, as it seems to be geared to a general public without specifying so. We recommend adding some content regarding the methods, the workflows and the interpretation to make it more useful to other archaeologists. Detailed comments by the reviewers won't be repeated here. Though we agree that a separate scientific paper would be a valuable further step in the publication of this research, we do not find this to be needed at this stage.

We also recommend to revise the English version (see esp. comments by Robert Bischoff) and maybe add a main menu (see comments by Scott Ure). The German website version is fine, but of course it should be updated as much as the English website.

Reviewed by Ronald Visser, 14 July 2023

The Github-repository under review shows an interesting way of sharing both archaeological information and 3D-models, using existing technologies (3DHop, Java-script, CSS, etc). The approach is clear and straightforward and is a low-cost approach. In addition, it follows the ideals of open science and FAIR-principles. I think that this is all commendable, since it makes archaeological information and archaeological reconstructions available for a wide public. However, I think that it is not completely clear who the intended audience for the the website itself is. This becomes not evident after reading the website, and the Readme.md does not descripe this either. I feel that this should be made more explicit: why did you build this nice website and for what audience. Some of the information seems to point to a general interested audience, while other information seems more intended for professional archaeologists. The website peaked my interest in the subject, and I really wanted to know more about the megalithic grave, but the information on the website was sometimes to shallow and lacked depth. I think that can easily be solved.
It is commendable that the website is available in both English and German, since it enables a wider public to access the information. Since the Düwelsteenen are found close to the Dutch border, a Dutch version, might be a future addition to pursue. Concering the languaes, it seems that the website was originally built in German and translated into English afterwards, sometimes resulting in Genglish. This is generally the case with the sentence structure, but it does not influence the understandability of the text. Therefore, I would suggest to have a native speaker (English) go over the language to improve this. This is not a must, but it would make it better.
The technologies behind the website are all open (except GoogleMaps) and fairly common in the archaeological community. In that sense the website builds further on what other archaeologists have done, and the use of relative standard technologies also improves the long lived availability of the 3D-models, information and website itself. However, I am not a specialist in building websites, so maybe a specialist in that field might think differently.
I really liked reading the Readme.md, since it explained several of the technological choices made to solve certain issues. However, I feel that a concise paper to supplement the website/Github-repository explaining the (scientific) backgrounds is seriously lacking. It would have been very interesting to read about the backgrounds in a scientific or scholarly paper. I also think that this would increase the value of the website for a archaeological audience. A paper as such would function as the paradata of the website and improve the scientific quality. In addition, to adhere better to the FAIR-principles a more complete metadata document would also improve the data set itself.
I think that you can be proud of what you achieved, but there is room for improvement. I hope that this review will help to improve the website and the accessibility of the information and data.

Reviewed by Robert Bischoff, 21 June 2023

3Duewelsteene Review

The submission titled “3Duewelsteene - A website for the 3D visualizazaon of the megalithic passage grave Düwelsteene near Heiden in Westphalia, Germany” is a website submited for review. The purpose of the website is to present the 3D reconstruction of the Düwelsteene megalithic tomb. My review found the website to be well organized and informative. The 3D reconstructions were of excellent quality, particularly considering the retrospective nature of the photogrammetry. The 3D tools embedded in the website were quite useful. The procedures and tools were noted in the text. The author is commended for providing a reconstruction that was useful for visualizing how the tomb may have appeared while also clearly differentiating the reconstruction from the original. This website represents a substantial academic contribution, as well as an excellent contribution to public archaeology. The text of the website could use some minor revision for grammar and readability. I

have included some specific notes.Website

Suggest reorder “The Düwelsteene from today to 3000 BC” to be “The Düwelsteene from 3000 BC to today”
Video “Video showing the changes over time and how the megalithic tomb Düwelsteene was built” is excellent

Front page is excellent

Page: 3D*Today*en.html
“Since the reconstruction in 1932, the tomb, as it can be found today, has the following dimensions: The entire tomb, which is oriented from the southwest to the northeast, has an outer length of 12 meters. Inside, the length is 10.2 meters. The width of the megalithic tomb is 2.7 meters to 4.3 meters on the outside, while the complex has a width from 1.5 meters to 2.2 meters inside.”
- Grammar needs to be cleaned up
“The positioning of the stones of the grave can be seen as a 3D reconstruction as well, in the state they were presumably in before the restoration in 1932.”
- Awkward comma placement

Page: 3D*before1932*en.html
“Reconstruction of the tomb before it was restorated in 1932.”
- Change restorated to restored
“There are photographs of the excavation, drawings were also made of the megalithic grave during the excavation.”
- Sentence should be separated with semicolon or split into two sentences.

Page: 3D*3000BC*en.html
“potential reconstruction of the tomb and how it could have looked like around 3000 BC”
- Capitalize potential and replace how with what
“Nowadays there almost all supporting stones and three capstones can still be seen.”
- Not sure what this means
“In this grave and on the stone pavement the dead were placed, they were given funerary goods, as evidenced by the finds of ceramics, animal bone artifacts and jewelry during the excavation at the Düwelsteenen.”
- There needs to be an “and” separating the two parts of the sentence

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Reviewed by **Scott Ure**, 04 July 2023

TITLE/ABSTRACT/INTRODUCTION

Does the title clearly reflect the content of the article?
Yes, it is appropriate.

Does the abstract present the supported findings of the study concerned and no other?
Yes, it focuses solely on the study in question.

Does the introduction clearly explain the motivation for the study?
Yes, the motivation for the study is clearly stated.

Is the research question/hypothesis/prediction clearly presented?
The research question is stated, but it could use some refinement to reduce repetition. The research statement is somewhat indirectly stated throughout the abstract. Some editing that focuses on a more direct statement would be helpful, in my opinion.

Does the introduction build on relevant recent and past research performed in the field?
The abstract uses some general terms (e.g., 3D model(s), digital methods, three-dimensional models), but it does not mention the more technical methods used to derive these datasets, such as structure-from-motion (SfM) or photogrammetry. I was expecting mention of these terms given their relevance to this subject. I would recommend focusing on these methods and literature that are heavily documented in previous archaeological research. NOTE: The SfM method is briefly mentioned on the website under the "Reconstruction History" section, but it is only briefly mentioned.

MATERIALS AND METHODS
Are the methods and analysis described in sufficient detail to allow replication by other researchers?
I would personally want to know more about the actual SfM methods used to reconstruct the megalithic tomb. I would also like to know more about how the data was captured. What scanners were used? What cameras were used? What software was used "stitch" the point clouds together? The author mentions some basics, but I would prefer more information. This information would help others replicate the methods used.

Is the experimental plan consistent with the questions?
The goal was to attempt to reconstruct this specific megalithic tomb as it was originally built using old photographs and current scans/photographs. I was confused about how this could be achieved and tested without additional information to produce the interpretation of the tomb as it was originally erected in 3000 B.C. Some additional data seems important here. Perhaps it is available in the archaeological datasets and could be shared on the website?

Are the statistical analyses appropriate?
N/A

Have you evaluated the statistical scripts and program codes?
N/A

RESULTS
Have you checked the raw data and their associated description?
N/A

Have you run the data transformations and statistical analyses and checked that you get the same results?
N/A

To the best of your ability, can you detect any obvious manipulation of data (e.g. removal)?
No, the data does not appear to be manipulated.

Do the statistical results strongly support the conclusion (p< 10-3 or BF>20)?
N/A

In the case of negative results, was a statistical power analysis (or an appropriate Bayesian analysis) performed?
N/A

Did the authors conduct many experiments but retain only some of the results?
N/A

DISCUSSION

Do the interpretations of the analysis go too far?

Yes, a little bit. It is unclear to me, at least with the information presented on the website, how the author decided what the tomb looked like in 3000 B.C. in the final rendering. I understand that this is highly interpretive, but I think it important to be explicit about the interpretation.

Are the conclusions adequately supported by the results?

The final interpretation of what the tomb looked like originally does not appear to match the results from the photogrammetry of recent and old photographs. I assume much of the data comes from other sources that are not fully explained. It would be helpful to know how the author decided to arrange the stones noted in the excavations into the position seen in the final models.

Does the discussion take into account relevant recent and past research performed in the field?

Yes, in part. The author discusses the archaeological work specific to the site itself but does not include a discussion of the methods/technology. I was hoping to see some mention of how SfM and photogrammetry have been used in past archaeological research and why these methods were choosing for this project instead of using other methods (artist reconstruction, etc.).

Did the authors test many hypotheses but consider only a few in the discussion?

I was not able to discern any hypothesis testing for this project.

REFERENCES

Are all the references appropriate?

Yes, they seem appropriate. I would suggest more references to support the study. They were also difficult to find on the website.

Are the necessary references present?

No. I would recommend a review of the literature on archaeological digital reconstruction (specifically SfM and photogrammetry) to include in this research. I think this is important given the focus of the research on these methods to derive the results.

Do the references seem accurate?

Yes, they appear to be accurate.

TABLES AND FIGURES

Are the tables and figures clear and comprehensive?

Yes, they are clear.

Are all the tables/figures useful?

Yes

Are there too many/too few tables and figures?

I think the number of figures is appropriate.

Do the tables and figures have suitable captions such that they can be understood without having to read the main text?

The image under the “tales” main section does not have a caption. The source for the image is listed when the user clicks on the section, but it is difficult to find at the bottom of the webpage. I would recommend using the

format under the “history of the excavation” section which includes the caption and source under the image.

CONCLUDING COMMENTS

I think this is a very interesting research project that integrates historic photographs with modern datasets from multiple sources. I believe the research has scientific merit and value to the regional archaeology. My concerns are noted above, but in general, I would recommend adding some specific details instead of using generalities. This is especially evident in the methods and results. I would also recommend some editing for clarity, grammar, wording, and general writing structure. I do not see any glaring problems, but some editing would refine the writing. I appreciate the novel approach of using a website to share research. I feel like the website was a little difficult to navigate at times. I had a hard time finding some of the elements (references, sources, captions, etc.). Perhaps the main menu could provide a link to some of the major elements for others to easily access. With a little refining and polishing, I think this study will be a nice addition to the body of work associated with archaeological digital reconstruction.

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